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NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202 755-8370

For Release Sunday,
January 11, 1976

Press Kit

Project Helios-B

RELEASE NO: 75-317

(NASA-News-Release-75-317) PROJECT HELIOS-B N76-71146
(NASA) 19 p

Unclas
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For Release:

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Sunday,
January 11, 1976

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RELEASE NO: 75-317

SECOND SOLAR PROBE READY FOR LAUNCH

The second of two spacecraft designed to fly closer to the Sun than any previous man-made object will be launched by NASA next month for West Germany.

Helios B will be launched from Kennedy Space Center, Fla., aboard a Titan Centaur rocket about Jan. 15. A one-hour launch window begins at 12:30 a.m. EST.

The spacecraft will be placed into a highly elliptical orbit around the Sun at distances ranging from 149,599,000 kilometers (89,700,000 miles) to 43,400,000 km (26,900,000 mi.). It will reach the closest point every 93 days.

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Named after the Sun god of ancient Greece, Helios was built by West Germany as part of a joint venture with the United States. Three of the 10 experiments on board are American. The United States also supplies the launch vehicle, tracking and data acquisition and technical support.

Helios B will fly nearly 3 million km (2 million mi.) closer to the Sun than its predecessor, Helios 1, which was launched a year ago. And it will experience about 10 per cent more heat than Helios 1, whose parts already have shown they can take temperatures of 370 degrees Centigrade (700 degrees Fahrenheit) -- the melting point of lead -- and continue to function well.

Instruments aboard the spacecraft will measure the solar wind (ionized particles given off by the Sun), magnetic fields, solar and galactic cosmic rays, electromagnetic waves, micrometeoroids and the zodiacal light (a diffuse glow seen in the east and west before sunrise and after sunset).

Information returned by Helios B is expected to shed more light on the unexpected micrometeorite results observed on Helios 1.

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Dr. James Trainor of NASA's Goddard Space Flight Center, Greenbelt, Md., the U.S. project scientist explains:

"Helios 1 detected about 15 times more micrometeorites close to the Sun 53 million km (33 million mi.) than observed near the Earth. They come from sharply defined but many different directions at different times.

"We don't know whether they are transported by the Sun's corona after being pulled into the Sun from elsewhere in space -- which would have an important impact on solar energy transport theory -- or whether they may be following the path of starlight directly in towards the Sun."

Trainor points out that Einstein's theory of relativity predicts that the immense gravitational attraction of the Sun bends light beams from distant stars in toward the Sun as the light passes by.

Instrumentation similar to that carried on Helios is carried on two Interplanetary Explorers or IMPs (Explorers 47 and 50) in Earth orbit; the Pioneer spacecraft orbiting the Sun at about one Astronomical Unit,* and on Pioneers 10 and 11 in the outer reaches of the solar system.

*One A.U.=149,599,000 km (89,700,000 mi.)

Data received by these spacecraft, which measure solar phenomena from various points in the solar system over a long period of time and under varying conditions, will be correlated with that received by the two Helios probes.

Germany's Bundesministerium fur Forschung und Technologie (BMFT) (Federal Ministry for Research and Technology) has overall management responsibility and the Deutsche Forschungs- und Versuchsanstalt fur Luft und Raunmfahrt (DFVLR) (German Aerospace Research and Experimental Establishment) serves as project manager.

The Goddard Center has overall project responsibility for U.S. participation, and NASA's Lewis Research Center, Cleveland, Ohio, manages the Titan Centaur/TE-364-4 rocket.

Telemetry data acquisition and tracking will be provided by NASA's Jet Propulsion Laboratory, Pasadena, Calif., which manages the Deep Space Network. Spacecraft control will be conducted by a German team at the German Space Operation Center (GSOC) near Munich, West Germany. Initial maneuvers will be monitored by a German team at JPL.

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Cost of the two Helios missions, including spacecraft and launch vehicle, is about $260 million. The German share is about $180 million. BMFT pays all spacecraft costs, which include the price of the two flight units, a prototype and thermal, structural and engineering models. Germany provides seven experiments, plus command and data acquisition costs for the German ground stations.

The U.S. pays for the two launch vehicles and their support, tracking and data acquisition services, the three U.S. experiments and other support for a total of about $80 million.

Prime contractor for the spacecraft is Messerschmitt-Bolkow-Blohm GmbH, Munich. The Martin Marietta Corp., Denver, Colo., builds the Titan III booster under contract to the U.S. Air Force Space and Missiles System Organization (SAMSO), acting as the procurement agency for LeRC. The Centaur upper stage is produced by General Dynamics/Convair and the TE-364-4 stage is provided by McDonnell Douglas Corp.

(END OF GENERAL RELEASE. BACKGROUND INFORMATION FOLLOWS.)

MISSION OBJECTIVES

The main scientific objectives of the Helios mission are:

- To study the spatial gradient of the interplanetary medium by measuring the magnetic field, the density, temperatures, velocity and direction of the solar wind, i.e., electrons, protons and alpha particles.

- To study discontinuities and shocks in the interplanetary medium magnetically, electrically and by observing the behavior of the solar wind particles.

- To study radio waves and in situ the electron plasma oscillations believed responsible for certain radio bursts (Type III) and other wave-particle interactions.

- To study the propagation of solar cosmic rays and to a certain degree their spectral composition.

- To measure the spatial gradient of galactic cosmic rays, to separate the solar and galactic components of the low energy cosmic ray flux especially with respect to protons and electrons.

- To study the spatial gradient and dynamics of the interplanetary dust and the chemical composition of dust grains by observing the zodiacal light and by counting and analyzing individual dust particles.

- To x-ray monitor the solar disk by means of a Geiger-Muller counter. This device will enable the experiments to monitor the far side of the Sun from orbit regions far from the Earth.

- To test the theory of general relativity with respect to both orbital and signal propagation effects:

  -- Determination of the dynamical oblateness of the Sun

  -- Determination of the quadrupole mass distribution of the Sun

  -- Improvement of the ephemerides of the inner planets and the Moon

HELIOS FACT SHEET

Spacecraft

Weight	376 kilograms (826 pounds) including 10 scientific experiments weighing a total of 72 kg (158 lb.).
Structure	Spool-shaped with an experiment compartment or central core 1.75 meters (5.7 feet) in diameter, cylindrical in shape (16 sides) and two conical solar arrays attached to both ends giving it a spool shape. Height with antenna mast, 4.20 m (13.7 ft.). Without antenna mast, 2.12 m (7.0 ft.). Diameter at widest point (solar arrays) 2.77 m (9.1 ft.). With deployable booms extended, 32 m (105.0 ft.) tip to tip.
Power	Solar cells located on solar arrays mounted above and below the spacecraft central body. Second surface mirrors are interspersed among solar cells to radiate excess heat. Cells supply minimum of 240 watts at aphelion (farthest from Sun) and considerably more at perihelion. Silver-zinc batteries provide power during initial phase of mission.
Telemetry and Command	The telemetry subsystem processes the scientific and engineering data for transmission. It is the connecting link between the various data sources and the communications subsystem. Data from the 10 scientific experiments and spacecraft housekeeping are merged and formatted in the data encoder for direct transmission to Earth.

The data handling equipment consists of a command decoder, data storage with a 500-kilobit core memory, an encoder and a telemetry control unit. The spacecraft is controlled by ground command.

Tracking and Data Acquisition	The DSN unified S-band system will be used for telecommunications utilizing the 26 m (85 ft.) antenna and the 64-m (210-ft.) antennas. Essentially continuous coverage will be provided during the primary mission (first 120 days). Mission control will be from the German Space Operation Center (GSOC) near Munich. The German Control Center (GCC) will interface with NASA's NASCOM facility in Madrid. The 100-m (325-ft.) antenna at Effelsberg, Germany, will be used as required, but only for telemetry reception.
Orbit	Elliptical, from one AU to 0.29 AU. 186-day period.

HELIOS B SCIENTIFIC EXPERIMENTS SUMMARY

No.	Experiment Title	Scientific Objectives - Measurement Of:	Investigators Name	Affiliation
1	Plasma Experiment	Density, temperature, velocity and direction of solar wind (low energy charged particles) flowing outward from Sun. Velocity distribution of positive component to be measured with high resolution in energy both in azimuth and elevation; electron component with resolution only in energy and azimuth.	H. Rosenbauer* H. Pellkofer R. Schwenn	Max-Planck-Institut fur Extraterrestrische Physik, Garching, West Germany
			J.W. Wolfe	NASA, Ames Research Center Mountain View, Calif.
2	Flux-Gate Magnetometer (Braunschweig)	Quasistatic component of interplanetary magnetic field along trajectory path; also measurement of magnetic shock waves. Characteristics of the magnetic field versus solar distance is of great interest. Field intensities to a few hundred gamma (as expected near the Sun), and intensity fluctuations in the frequency range of 0 to 4.7 Hz to be measured in each of three orthogonal axes.	G. Musmann* F.M. Neubauer	TV Braunschweig, Institut fur Geophysik und Meteorologic, West Germany
3	Flux-Gate Magnetometer (GSFC, Rome)		N.F. Ness* L.F. Burlaga	NASA, Goddard Space Flight Center, Greenbelt, Md.
			F. Mariani S. Cantarano	Universita degli Studi, Instituto di Fisica, "G. Marconi," Rome, Italy
4	Search-Coil Magnetometer	Magnetic field intensity fluctuations and shock wave forms. Fluctuations in frequency range 5 Hz to 3 KHz measured in three orthogonal axes; spectral resolution also to be achieved in the direction parallel to spacecraft spin axis.	G. Dehmel* F.M. Neubauer G. Schirenbeck R. Karmann	TV Braunschweig, Institut fur Nachricktentechnik, Germany
5	Plasma and Radio Wave Experiment	Electrostatic and electromagnetic wave phenomena and electrical shock waves in the frequency range from 10 Hz to 2 MHz. This range encompasses Type III radio noise phenomena and associated longitudinal electrostatic waves down to solar wind plasma frequency.	D.A. Gurnett* G.W. Pfeiffer	Univ. of Iowa, Dept. of Physics and Astronomy
			P.J. Kellogg	Univ. of Minnesota, School of Physics and Astronomy
			S.J. Bauer R.G. Stone	NASA, Goddard Space Flight Center, Greenbelt, Md.
6	Cosmic Ray Experiment (Kiel)	Energy spectra, angular distribution and time variation of protons, alpha particles and heavier nuclei particles of solar and galactic origin in low, medium and high energy ranges to 1 GeV.	H.G. Hasler* H. Kunow R. Muller	Universitat Kiel, Institut fur Reine und Angewandte Kernphysik, West Germany

*Principal Investigator

HELIOS B SCIENTIFIC EXPERIMENTS SUMMARY (Cont'd.)

No.	Experiment Title	Scientific Objectives - Measurement Of:	Investigators: Name	Investigators: Affiliation
7	Cosmic Ray Experiment (GSFC)	In addition, Experiment 7 will monitor solar X-ray emissions. Of primary interest are particle propagation mechanisms and their energy spectrum as a function of solar distance and solar activity.	J.H. Trainor* F.B. McDonald B.J. Teegarden K.G. McCracken	NASA, Goddard Space Flight Center, Greenbelt, Md. CSIRO, Melbourne, Australia
8	Electron Detector	Energy spectra and flux density of medium energy electrons in the range of about 40 KeV to 1 Mev. Correction of observations with solar distance and with other science measurements will contribute to the understanding of electron propagation and electron events in space.	E. Keppler* B. Wilken G. Umlauft D. Williams	Max-Planck-Institut fur Aeronomic, Lindau/Harz, Germany NOAA, Boulder, Colo.
9	Zodiacal Light Photometer	Intensity and polarization in different wavelengths of zodiacal light (sunlight scattered by interplanetary dust). Use three photometers oriented at three different look angles to ecliptic. Provides information to assess the quantity, distribution and nature of particulate matter in space.	C. Leinert* E. Pitz H. Link	Landessternwarte Heidelberg, West Germany
10	Micrometeoroid Detector and Analyzer	Mass and energy of dust particles 10^{-14} grams; mass spectrum of particles 10^{-13} grams. Enables determination of spatial gradient, size and dynamics of dust particles in region of 1 AU to 0.30 AU.	E. Gruen* P. Gammelin H. Fechtig	Max-Planck-Institut fur Kernphysik, Heidelberg, West Germany
11	Celestial Mechanics Experiment	Orbit parameters to test theories of general relativity with respect to both orbital and RF signal propagation effects. Provides data for determination of solar quadrupoles moment, improvement of the ephemerides of the inner planets and measurement of the integrated electron density between the spacecraft and the Earth.	W. Kundt* W.G. Melbourne J.D. Anderson	Universitat Hamberg, Institut fur Theoretische Physik Jet Propulsion Laboratory, Pasadena, Calif.

LAUNCH FACILITIES

Helios B will be launched aboard Titan Centaur-5 from Complex 41 of the Titan III Complex, Air Force Eastern Test Range. Launch will be under the direction of the John F. Kennedy Space Center's Unmanned Launch Operations Directorate.

The Titan III Complex -- built on manmade islands in the Banana River -- consists of: solid rocket motor servicing and storage areas; a Vertical Integration Building (VIB); a Solid Motor Assembly Building (SMAB); Launch Complexes 40 and 41; and a double-track locomotive system which transports the mated Titan core and Centaur vehicle from the VIB through the SMAB to Launch Complex 41. The rail system covers a distance of about 20 miles to link the various facilities of the complex.

HARDWARE ASSEMBLY

The Titan, Centaur and Centaur portion of the shroud are erected and mated in the VIB on a mobile transporter/ umbilical mast structure. Attached to the transporter are three vans housing launch control and monitoring equipment which remain connected to the transporter and vehicle throughout the receipt-to-launch sequence. Upon completion of integrated tests in the VIB, the assembled Titan and Centaur are moved on the transporter to the SMAB. After the solid rocket motors and liquid-fueled stages are structurally mated, the vehicle is moved to Launch Complex 41. A mobile service structure provides access to all mated vehicle stages. An environmental enclosure or "white room" provides protection for the Centaur and the spacecraft.

The spacecraft prelaunch operations include checkout, fueling and encapsulation in the payload section of the shroud and mating of the encapsulated spacecraft with Centaur at Complex 41. Spacecraft are assembled and encapsulated at the Spacecraft Assembly and Encapsulation Facility (SAEF) at KSC.

The VIB is a 23-story structure enclosing 9 million cubic feet of space. The VIB, located 20,000 feet from Complex 41, has two major functions: launch control and core vehicle assembly and systems checkout.

The VIB has four individual bays or cells in which four Titan rockets can be assembled and all systems checked out before the rocket is moved on to the SMAB for mating of the solid rocket motors. The VIB launch control area -- consisting of three rooms -- is the nerve center of the Titan III Complex.

COMPLEX MODIFICATIONS

The Titan III Complex was modified to support assembly, checkout and launch of the Titan Centaur. Complex 41 is under operational assignment to KSC and necessary modifications were funded by NASA.

The Titan Centaur rocket substitutes the high-energy, hydrogen-fueled Centaur upper stage for the transtage flown on Air Force versions of the Titan III.

Most of the launch complex modifications were required to service the hydrogen-fueled Centaur. Modifications included the laying of concrete foundations for cryogenic handling and storage areas and modifications to work platforms in Cell 1 of the VIB. Also included was the reconfiguring of the "white room" of the Mobile Service Tower to accommodate the Helios and Viking spacecraft and a larger payload shroud. The new shroud covers both Centaur and its payload.

The first NASA mission launched from Complex 41 was the Titan Centaur-1 test flight on Feb. 11, 1974. Complex 41 was also used for the Helios 1 launch of Dec. 10, 1974, and the twin Viking launches on Aug. 20 and Sept. 9. This will be the fifth NASA mission from Complex 41.

TC-5 HISTORY

The Titan first and second stages were erected on their transporter Sept. 11-12 and the Centaur upper stage was mated with them Sept. 17. TC-5 was moved in to the SMAB Oct. 31 where the twin solid boosters were mated with the core vehicle in early November. The combined launch vehicle was moved the 2.8 miles from the SMAB to Complex 41 Nov. 4.

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The Helios B spacecraft arrived at KSC Oct. 7 and received a preliminary checkout in Hangar AO at Cape Canaveral Air Force Station. It was moved to Spacecraft Assembly and Encapsulation Facility-1 (SAEF-1) in the KSC Industrial Area Nov. 26 for further checkout and flight preparation. It was mated with its Delta third stage (TE-364-4) rocket motor Dec. 8 and encapsulated in the Centaur Standard Shroud Dec. 9.

The encapsulated spacecraft was scheduled to be moved from SAEF-1 to the pad for erection and mating with TC-5 early in January, 1976.

TITAN/CENTAUR/HELIOS B SEQUENCE OF EVENTS

Event		Time
Separate Forward Bearing Reactors	T + 100 Sec	1 min. 40 sec.
Stage I Ignition	112	1 min. 52 sec.
SRM Jettison	124	2 min. 4 sec.
Stage I Cutoff	262	4 min. 22 sec.
Stage I Jettison	262	4 min. 22 sec.
Stage II Ignition	262	4 min. 22 sec.
Centaur Shroud Jettison	322	5 min. 22 sec.
Stage II Cutoff	468	7 min. 48 sec.
Stage II Jettison	474	7 min. 54 sec.
Centaur MES-1	484	8 min. 4 sec.
Centaur MECO-1	582	9 min. 42 sec.
Centaur MES-2	1,890	31 min. 30 sec.
Centaur MECO-2	2,185	36 min. 25 sec.
TE-364 Spinup (MECO-2+70)	2,255	37 min. 35 sec.
TE-364 Separation (MECO-2+72)	2,257	37 min. 37 sec.
Centaur Retro (MECO-2+72)	2,257	37 min. 37 sec.
TE-364 Ignition (MECO-2+114)	2,299	38 min. 19 sec.
TE-364 Burnout	2,342	39 min. 2 sec.
Spacecraft Separation (MECO-2+230)	2,415	40 min. 15 sec.
TE-364 YO Deploy (MECO-2 +256)	2,441	40 min. 41 sec.
Switch to Hi-Gain Antenna	4,185	69 min. 45 sec.

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Event		Time
Verify R Vector Align (MECO-2+2160)	4,345	1 hr. 12 min. 25 sec.
Centaur MES-3 (MECO-2 +18,900)	21,085	5 hr. 51 min. 25 sec.
Centaur MECO-3 (MES-3+11)	21,096	5 hr. 51 min. 36 sec.
Centaur MES-4 (MECO-3+1800)	22,896	6 hr. 21 min. 36 sec.
Centaur MECO-4 (MES-4+14)	22,910	6 hr. 21 min. 50 sec.
Centaur MES-5 (MECO-4+1200)	24,110	6 hr. 41 min. 50 sec.
Centaur MECO-5 (MES-5+6)	24,116	6 hr. 41 min. 56 sec.
Centaur MES-6 (MECO-5+300)	24,416	6 hr. 46 min. 56 sec.
Centaur MECO-6 (MES-6+7)	24,423	6 hr. 37 min. 3 sec.
Centaur MES-7 (MECO-6+7200)	31,623	8 hr. 47 min. 3 sec.
Centaur MECO-7 (MES-7+7)	31,630	8 hr. 47 min. 10 sec.
Mission Complete	32,235	8 hr. 57 min. 15 sec.

NOTE: Event times are nominal and apply to the Dec. 8, 1975, launch opportunity at window opening. Event times will vary according to launch date and time.

HELIOS PROGRAM/PROJECT MANAGEMENT

Federal Republic of Germany

Karl Kasmeier	Program Manager, Bundesministerium fur Forschung und Technologie (BMFT)
Dr. Wolfgang Finke	Director of Space and Transportation, BMFT
Herman Strub	Deputy Director for Space, BMFT
Manfred Otterbein	Program Scientist, BMFT
Ants Kutzer	Project Manager, Bereich fur Projekttraegerschaften (BPT) fur Weltraumforschung
Friedrich Unz	Deputy Project Manager, BPT
Dr. Herbert Prosche	Project Scientist, Arbeitsgemeinschaft fur Weltraumforschung (AFW)

NASA Headquarters

Dr. Noel W. Hinners	Associate Administrator for Space Science
Dr. Anthony Calio	Deputy Associate Administrator for Space Science
Dr. S. Ichtiaque Rasool	Deputy Associate Administrator for Space Science (Science)
Robert Kraemer	Director, Planetary and Lunar Programs
Fred D. Kochendorfer	NASA Program Manager
Dr. Albert Opp	NASA Program Scientist

John F. Yardley	Associate Administrator for Space Flight
Joseph B. Mahon	Director, Expendable Launch Vehicles
F. Robert Schmidt	Acting Manager, Titan Centaur
Gerald M. Truszynski	Associate Administrator for Tracking and Data Acquisition
Maurice E. Binkley	OTDA Support Manager

<u>Goddard Space Flight Center</u>

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Dr. Robert S. Cooper	Deputy Director
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Charles B. White	Assistant Project Manager
William R. Witt, Jr.	Assistant Project Manager
Dr. James H. Trainor	Project Scientist

<u>Jet Propulsion Laboratory</u>

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Paul S. Goodwin	Deep Space Network Manager
Willis Meeks	Deep Space Network Manager

Kennedy Space Center

Lee R. Scherer	Director
George F. Page	Director, Unmanned Launch Operations
John J. Neilon	Helios Launch Director
D. C. Sheppard	Chief, Spacecraft Operations
Floyd Curington	Spacecraft Coordinator
John D. Gossett	Chief, Centaur Operations Division
Creighton A. Terhune	Test Engineering Chief

CONTRACTORS

Spacecraft

Messerschmitt-Bolkow-Blohm GmbH, Munich	Prime contractor for Helios

Launch Vehicle

Martin Marietta Denver, Colo.	Prime contractor for Titan
General Dynamics/Convair	Centaur
McDonnell Douglas	TE-364-4

December 24, 1975